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Hybrid Technique for Facial Expression Recognition: A Survey

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Abstract

Facial expression recognition is an emerging technique in the field of image processing. This paper gives an idea about identifying face expressions such as anger, happiness, neutral, sad, surprise. This can be use to process photographs and videos to recognize human faces, or even handwriting. The vision of intercourse is effective by means of communication for human beings as social beings. A small change in facial expression signifies happiness, sorrow, surprise and anxiety. The face expression of each person will vary in many factors such as lighting, background and posture. FER plays an important role in the artificial intelligence. Machines are able to provide personalized services according to the human's emotion information. There are plenty of applications like virtual reality, customer satisfaction, personalized recommendations depends on efficient and reliable way to recognize the facial expressions.

Keywords: : face expression, face recognition, image processing.

1. INTRODUCTION

Facial emotion recognition is a current trending research topic in artificial intelligence, computer vision and internet of things domain. However, expression recognition is a wide task for computers. The process of recognizing facial expressions can be divided into three steps: image processing, feature extraction and facial expression classification.

In an emerging research topic for proximity service, safe, natural, and advanced human robot interaction (HRI) system is not only provide physical contact between robots and human beings, it also provides emotional interaction. Content based image retrieval has been a hot topic for years. Retrieving similar images from small database is quite difficult from that of large database. CNN has shown higher results in image tasks such as classification, detection, retrieval, segmentation and more. By using convolutional neural network technique content based fine grained image retrieval will get large amount of database. Facial emotions play an important role not only in daily life relations with other people but also in the way of using computers.

Emotion plays an important role in providing useful information such as a person's state of mind. The emotion recognition system depends on image processing technique for face detection and feature extraction. The facial part of a user is find out either from a static image or from a frame extracted from a video. To determine significant facial features the extracted facial regions are further processed. To detect emotions physiological signals include electroencephalography and electrocardiogram among other have been used

2. LITERATURE SURVEY

khadija[1] et.al. explains SVM (support vector machine) is used for face detection in facial expression recognition. For face recognition local binary pattern, compound local binary pattern, and dynamic LTP (local ternary pattern) are used. The parameters of the facial expression recognition and characteristics are very sensitive to ROIs (region of interests) size. To get the best recognition performance all these parameters as well as the threshold of local ternary pattern (LTP) descriptor were optimized. The methods, advantages and how to improve the address drawbacks of the descriptor of LBP suggested LBP, which includes the sign and magnitude of the variations between the grey value of the middle and the neighbour.

And also HOG specification can make HOG descriptor one of the powerful methods for facial expression recognition. Median ternary pattern is a new local texture pattern, it incorporates the advantages of median filter and quantization of gray scale values into 3 value codes. For facial landmark representation the whole face shape uses geometric based approaches. To extract geometric information the movement and position of facial landmarks are calculated. Facial expression by using active appearance models (AAM) to bring out key attributes and observing changes of their value using Fuzzy logic to extract facial feature points active shape model (ASM) fitting methods are used. The geometric displacement of projected ASM feature points and the mean shape of ASM were analysed to identify facial expressions. The main aim of this work is to identify automatically the six basic emotions as well as the neutral state by applying appearance feature methods like LBP and its variable to new specific face-regions.

Rahul Ravi[2] et.al. described a face expression recognition using face regions methods with CNN and LBP with a classifier SVM. The image is scaled which can be processed easily without compromising the vital characteristics to obtain a correct prediction, this is the purpose of CNN architecture. The main advantages in CNN method recognition rate is improved up to 97.32% on the ck++ dataset. But it had limitations on YALE data set recognition was only 31.82%.

In this work geometry and appearance based techniques are presently used in the feature extraction. Global face descriptor (GFD) and local face descriptor (LFD) are the most oftenly used feature representation methods. For dividing the hole image into multiple different images the local face descriptor are used, then only we can extract the features, but in case of global face descriptor it uses the entire image to draw out a depiction. To classify the images in CNN approach, it contains built in integrated classifier called soft max. The objective of CNN is to transform the set of inputs into accurate and reasonable results. The convolutional neural network is nearly similar to the human brain communication patterns of neurons. the use of CNN architecture is that scaling the image to a type which can be processed easily without compromising the vital characteristics in order to get precise prediction, CNN has an integrated classifier that is soft max it helps to classify the tested images.

Malyala Divya[3] et.al. describes deep learning approach is proposed for facial expression recognition. The techniques used are CNN, SVM, VGG-16, ResNet-50, Transfer learning, ensemble learning. Here the dataset used for facial expression recognition is from kaggle and karelinska directed emotional faces. Expression found only using greyscale images, proposed work is implemented even for colour images and a video stream as well.

The fractal compression technique for image works on self similarity. In a baseline fractal compression the image divides in non overlapping equal size segments called as range block (Rb) and overlapping unequal size blocks called as domain block (Db). For each Rb at least the double of Db with certain transformations is being recorded in the compressed image data. In this work the accomplishment has experimentally proven that the proposed HFVS technique increases fractal compression on both grey and colour images. The upshot shows clearly that block size of Rb_{max} = 16 and Rb_{min} = 8 improves image PSNR and CR compared to the baseline or fixed size block compression.

Chun Hsien Lin[4] et.al. interpret for image classification the facial emotion recognition uses convolution neural network algorithm. In this survey, the advantages are to initialize the image statically or dynamically by adding a co evolutionary layer, pooling layer, etc. The function take out by the ax-pooling method. The influence of this project is to show 66 percent of each emotion and accuracy achieved.

Sreemanth pisupathi[5] et.al. Elucidate for customising deep learning based facial expression recognition model uses adaptive features mapping. Cross domain adaptation, recognition of facial expression, computer vision, pattern recognition, image processing these technique are applied. The main characteristic used is LBP. In pre-processing approach the CNN method achieves more accuracy rate in facial image processing applications.

In this work weighted centre regression adaptive feature mapping (W-CR-AFM) is mainly proposed to transform the feature distribution of testing samples into that of training samples. However, in practical applications the handcrafted features have their own drawbacks, so deep learning methods are used to make the models learn to extract the complex features from high amount of facial expression data. There is no clear rule for determining the architecture and learning parameters for deep leaning neural networks, so image processing will acquire to improve the neural networks performance. In this work author proposes a 2 channel CNN, and the first convolutional layer in one of the channel is trained by convolutional auto encoder (CAE) to learn the better capacity in order to extract better features. In this paper there are two main contributions are proposed for the general facial image processing and it does improve the performance by preprocessing method. And the next is domain adaptation methods, AFM's, for training data is proposed, which can fine tune the parameters productively.

Xue-wen chen[6] et.al. describes the clustering based approach. For face recognition PCA and LDA technique are used. The characteristics for clustering based discriminant analysis with multiple clusters, eigenvectors, clusters, and a fuzzy c-means (FCM) clustering algorithm. The dimensionality of face image is very high CDA method, it provides efficient feature reduction, extraction schemes useful for facial expression recognition can be applied to face recognition as well these are added advantages of facial expression recognition. The drawback of this approach does not offer the best result.

In this paper selected some facial regions manually and apply optical flow to evaluate the motion of facial muscles and a k-nearest neighbour rule for recognition, here the optical movement is used to track the motion of brows, eyes, nose and mouth regions. For classifying facial expression 2D Fourier transform co-efficient of optical flow and hidden markov model was used. Here principal component analysis (PCA) is used for feature extraction and this is an unsupervised technique, which treats samples of the similar class and of different classes the same way. Here in clustering based discriminant analysis each image can be treated as a feature vector by concatenating the rows of the image together, using each pixel as a single feature.

Yuxiao Hu[7] et.al. proposed multiview facial expression recognition, the techniques used here is classifier fusion, PCA, locality preserving projection, LDA methods, classifications, BU-3DFE data, and pre-processing. The characteristics are locality preserving projection, nearest neighbour, pose emotion cascade, LBD and SIFT features. The advantages are that view identification is quite straight forward since the wide range of viewing angles is very simple. The drawback of this survey is required to minimize angle intervals.

On the investigation of multi view facial expression recognition, some of the methods to develop under multiple view angles for recognising facial expressions. We apply local binary pattern (LBP), histogram of oriented gradients (HOG), and scale invariant feature transform (SIFT) to identify facial expressions. And also investigate the influence of feature dimension reduction and classifier fusion on the recognition performance. A recent database named BU-3DFE database is building readily accessible database of 3D facial expressions.

Bing-fei Wu[8] et.al. explains the face expression recognition with a 2 channel convolutional neural network techniques involved here are feature extraction, face recognition, neural nets. This achieves an average of 95.8% accuracy, which is 8.2%. Higher than what was reported. Limitation is that it does not rely on any extraction of hand crafted or task specific features, but exploits unsupervised learning. Recognizing basic emotions are still a challenging issue in computer vision, lately deep learning has gained more attention to solve this problem. Convolutional neural network technique performs resizing, face detection, cropping and adding noises. And by enhancing the dataset in convolutional neural network, it achieves 97.06% of accuracy. In CNN technique pre-processing step is applied for face detection, cropping, resize, adding noise and data normalization.

K, naga Lakshmi[9] et.al. explains face expression recognition LBP technique is used for face recognition and for face detection haar-cascade classifier is used. Haar-cascade classifier method is a famous face detection technique due to its robustness. The model containing these two techniques that is LBP and Haar transform the recognition rate is increased. The outcome of this work is to find out the percentage of respective emotion with each individual facial image, like 82% of accuracy is attained for displaying the expression on the face as happy, 73% for sad and 95% for neutral.

Buzzo[10]et.al. employs an optimized hybrid filter, using empirical mode decomposition (EMD) and genetic algorithms (GA). In order to separate the intrinsic mode function (IMFs) corresponding to the plurality of the energy content of the initial signal for classification. The filter signal is constructed by the selected IMFs and is subjected to higher order crossings (HOC) analysis for feature extraction. In order to implement an energy based filter the EMD algorithms along with a simple genetic algorithm were used after the signals were imposed to the aforementioned filter, the HOC analysis Was employed in order to extract the feature vector.

Y LUO[11] et.al. outlines the facial expression recognition based on fusion features of PCA and LBP with SVM. For feature extraction principal component analysis (PCA) and local binary pattern (LBP) are used and support vector machine (SVM) is used to detect the face expressions. PCA is a technique for extracting face expressions based on statistical features which were extracted the global gray scale features of the mouth region, which provides most to facial expression recognition, to aid the global gray scale features of facial expression recognition. SVM is a technique which can classify different expressions more effectively and can get higher recognition rate than the earlier recognition technique.

CONCLUSION

In this survey the aspiration to found the latest advances in face expression recognition and the associated areas in a manner that should be understandable even by the immigrant who are interested in this domain but have no background knowledge on the same. From past decades face expression recognition systems have improved a lot. The summary of the survey has been discussed in below table.

References	Feature extraction techniques	Classifier	Database	Recognition rate in (%)	Limitations
Khadija lekdioui, 2017, [1]	Local binary pattern [LBP], compound local binary pattern [CLBP], local ternary pattern [LTP].	Support vector machine [SVM]	ck database, FEED database.	94.11% on ck database, 87.5% on FEED database.	Difficult to identify the posed facial expressions.
Rahul Ravi S, 2020, [2]	Convolution neural network [CNN], Local binary pattern [LBP].	Support vector machine [SVM]	ck+ dataset, YALE face dataset.	97.32% on ck+ dataset, 31.82% on YALE face dataset	In CNN computation is more but in LBP accuracy is less compared to CNN.
Mayela Divya, 2017, [3]	Local binary pattern [LBP]	Haar cascade	ck+ dataset	79% on ck+ dataset	Accuracy is less.
Nikhila, 2017, [4]	Local binary pattern [LBP], Deep convolutional neural network [DCNN].	Support vector machine [SVM]	ck+ dataset	86.83% on ck+dataset	None
Xue-wen chen, 2002, [9]	Principal component analysis [PCA], Linear discriminant analysis [LDA].	Haar cascade	FEED database	97.5% on LDA, 98.2% on PCA.	The trade off between information loss
Yuxiuo Hu, 2008, [11]	Local binary pattern [LBP], Histogram of oriented gradients [HOG], Sacle invariant feature transform [SIFT].	Cascade classifier	BU-3DFE	None	None
Yuuo, 2013, [16]	Principal component analysis [PCA], Local binary pattern [LBP].	Support vector machine [SVM]	ck+ dataset	88.76% on ck+ dataset	None

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